

THE INVENTION CLAIMED IS:

1. A load/unload mechanism adapted to load a substrate carrier onto a moving conveyor, the load mechanism  
5 comprising:

an arm having a first end and a second end, the arm being mountable by its first end for rotation about a horizontal axis;

an end effector mounted at the second end of the  
10 arm and adapted to support the substrate carrier; and

an arm moving mechanism coupled to the arm and adapted to rotate the arm such that the end effector is lowered while substantially matching a velocity of the end effector to a velocity at which the conveyor moves.

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2. The load mechanism of claim 1, wherein the horizontal axis is substantially transverse to a direction of travel of the conveyor.

20 3. The load mechanism of claim 1, wherein the end effector is cup-shaped.

4. The load mechanism of claim 3, further comprising a constraining mechanism adapted to constrain the  
25 end effector to have a fixed orientation as the arm rotates.

5. The load mechanism of claim 4, wherein the fixed orientation of the end effector is such that an open side of the cup-shaped end effector is oriented upwardly.

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6. The load mechanism of claim 4, wherein the constraining mechanism includes:

a first pulley at the first end of the arm and fixedly mounted relative to a mounting location of the arm;

a second pulley at the second end of the arm, the second pulley being fixedly coupled to the cup-shaped end effector and rotationally mounted relative to the arm; and

5 a belt that engages both the first pulley and the second pulley.

7. The load mechanism of claim 1, wherein the load member is configured to support the substrate carrier in a vertical orientation.

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8. A method of unloading a substrate carrier from a moving conveyor, comprising:

transporting a substrate carrier via a conveyor;  
about a horizontal axis, rotating an arm having an  
15 end effector couple thereto;

substantially matching a velocity of the end effector to a velocity at which the substrate carrier is transported by the moving conveyor;

20 contacting the substrate carrier with the end effector; and

lifting the substrate carrier from the conveyor.

9. The method of claim 8, further comprising:  
constraining the end effector to have a fixed  
25 orientation as the arm rotates.

10. The method of claim 9, wherein:  
the end effector comprises a cup-shaped end  
effector; and

30 the fixed orientation of the end effector is such that an open side of the cup-shaped end effector is oriented upwardly.

11. The method of claim 8, wherein the substrate carrier is in a vertical orientation during the transporting step.

5 12. The method of claim 8, wherein the substrate carrier is a single substrate carrier.

13. A method of loading a substrate carrier onto a moving conveyor, comprising:

10 supporting a substrate carrier via an end effector coupled to a rotatable arm;

about a horizontal axis, rotating the arm;

substantially matching a velocity of the end effector to a velocity at which the conveyor moves; and

15 lowering the substrate carrier onto the conveyor while continuing to substantially match the velocity of the end effector to the velocity of the conveyor.

20 14. The method of claim 13, further comprising: constraining the end effector to have a fixed orientation as the arm rotates.

25 15. The method of claim 14, wherein: the end effector comprises a cup-shaped end effector; and

the fixed orientation of the end effector is such that an open side of the cup-shaped end effector is oriented upwardly.

30 16. The method of claim 13, wherein the substrate carrier is in a vertical orientation during the supporting step.

35 17. The method of claim 13, wherein the substrate carrier is a single substrate carrier.

18. An apparatus for supplying substrates to a processing tool, comprising:

a load port;

5 an unload mechanism adapted to unload a substrate carrier from a substrate carrier transport system, the unload mechanism including:

an arm having a first end and a second end, the arm being mounted by its first end at a mounting  
10 location for rotation about a horizontal axis; and

an end effector mounted at the second end of the arm and adapted to support the substrate carrier; the unload mechanism being adapted to hand off at a transfer station a substrate carrier unloaded from the  
15 substrate carrier transport system;

a substrate carrier handler adapted to transport a substrate carrier from the transfer station to the load port; and

a mechanism adapted to rotate the unload mechanism  
20 such that at a time when the end effector contacts the substrates carrier, the end effector has a velocity that substantially matches a velocity of the substrate carrier while the substrate carrier is moving along a conveyor.

25 19. The apparatus of claim 18 wherein the load port is adapted to dock a substrate carrier.

20. The apparatus of claim 18 further comprising at least one storage shelf for storing substrate carriers,  
30 and wherein the substrate carrier handler is further adapted to transport a substrate carrier to and from the at least one storage shelf.

21. A load/unload mechanism adapted to load a substrate onto a moving conveyor, the load mechanism comprising:

an arm having a first end and a second end, the  
5 arm being mountable by its first end for rotation about a horizontal axis;

an end effector mounted at the second end of the arm and adapted to support the substrate; and

an arm moving mechanism coupled to the arm and  
10 adapted to rotate the arm such that the end effector is lowered while substantially matching a velocity of the end effector to a velocity at which the conveyor moves.

22. A load/unload mechanism adapted to load a  
15 substrate onto a moving conveyor, the load/unload mechanism comprising:

an arm having a first end and a second end, the arm being mountable by its first end for rotation about a horizontal axis;

20 an end effector mounted at the second end of the arm and adapted to support the substrate; and

an arm moving mechanism coupled to the arm and adapted to rotate the arm such that the end effector is lowered while substantially matching a velocity of the end  
25 effector to a velocity at which the conveyor moves.

23. A load/unload mechanism adapted to load a substrate onto a moving conveyor, the load mechanism comprising:

30 an arm having a first end and a second end, the arm being mountable by its first end for rotation about a horizontal axis;

an end effector mounted at the second end of the arm and adapted to support the substrate; and

an arm moving mechanism coupled to the arm and adapted to rotate the arm such that the end effector is lowered while substantially matching a velocity of the end effector to a velocity at which the conveyor moves.